

The University of the State of New York

283D HIGH SCHOOL EXAMINATION

PLANE GEOMETRY

Tuesday, January 20, 1942 — 9.15 a. m. to 12.15 p. m., only

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Instructions

*Do not open this sheet until the signal is given.*

Part I

*This part is to be done first and the maximum time allowed for it is one and one half hours.*

If you finish part I before the signal to stop is given you may begin part II. However, it is advisable to look your work over carefully before proceeding, since *no credit will be given any answer in part I which is not correct and in its simplest form.*

When the signal to stop is given at the close of the one and one half hour period, work on part I must cease and this sheet of the question paper must be detached. The sheets will then be collected and you should continue with the remainder of the examination.

Parts II, III and IV

Write at top of first page of answer paper to parts II, III and IV (a) name of school where you have studied, (b) number of weeks and recitations a week in plane geometry, (c) author of textbook used.

The minimum time requirement is five recitations a week for a school year.

See instructions for parts II, III and IV on page 1.

## Part II

Answer two questions from this part.

- 26 Prove that the area of a parallelogram is equal to the product of its base and its altitude. [10]
- 27  $AB$  is a diameter of a circle and  $C$  is any point on the circle. Chord  $AC$  is drawn and extended to  $D$  so that  $AC = CD$ , and  $DB$  is drawn. Prove that  $DB = AB$ . [10]
- 28 Prove that if two triangles have an angle of one equal to an angle of the other and the sides including these angles proportional, the triangles are similar. [10]

## Part III

Answer two questions from this part.

- 29 The base of a triangle is 30 inches and the altitude on this base is 15 inches. Find the area of the trapezoid formed by a line parallel to the base and 9 inches from the opposite vertex. [10]
- 30 The altitude on the hypotenuse of a right triangle divides the hypotenuse into segments of 9 and 4. Find, correct to the nearest degree, the smaller acute angle of the original triangle. [10]
- 31 In triangle  $ABC$ , angle  $C = 90^\circ$ ,  $CM$  is the median to  $AB$  and  $MD$  is perpendicular to  $CB$ . If  $CM = 10$  and  $MD = 8$ , find the perimeter of triangle  $ABC$ . [10]

## Part IV

Answer one question from this part.

- 32 For each of the following statements indicate whether you have been given too little information, just enough information or more information than is needed to justify the conclusion:
- a If  $A$  is 10 miles from  $B$  and  $B$  is 15 miles from  $C$ , then  $A$  is 25 miles from  $C$ . [2]
- b If the length of its apothem and the length of its radius are given, a regular pentagon can be constructed. [2]
- c If two boys are first cousins, then their fathers are brothers. [2]
- d If the perimeter and a diagonal of a rectangle are known, then the dimensions of the rectangle can be found. [2]
- e  $A$  arrived in Chicago 10 hours after a theft was committed in New York. If the fastest train from New York to Chicago makes the trip in 16 hours, then  $A$  did not commit the theft. [2]
- 33 Prove that if the three sides of a triangle are unequal, the bisector of any angle of that triangle can not be perpendicular to the opposite side. [Suggestion: Use the indirect method.] [10]

Fill in the following lines:

Name of school.....Name of pupil.....

Detach this sheet and hand it in at the close of the one and one half hour period.

## Part I

Answer all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Each answer must be reduced to its simplest form.

Directions (questions 1-13) — Write on the dotted line at the right of each question the expression which when inserted in the corresponding blank will make the statement true.

1 If two lines are cut by a transversal making two alternate interior angles equal, the sum of the two interior angles on the same side of the transversal is ... degrees. 1.....

2 If two tangents from an external point to a circle intercept a major arc of  $210^\circ$ , the angle between the tangents contains ... degrees. 2.....

3 From a point  $P$  outside a circle, a secant  $PCA$  is drawn. If  $PC$  equals 4 inches and  $PCA$  equals 16 inches, then the length of a tangent drawn to the circle from  $P$  is ... inches. 3.....

4 If the sides of two regular hexagons are in the ratio 1:3, their areas are in the ratio .... 4.....

5 In right triangle  $ABC$ ,  $C$  is the right angle and  $CD$  is the altitude on  $AB$ . If  $AB = 9$  and  $AC = 6$ , then  $AD = \dots$  5.....

6 If an exterior angle of an equiangular polygon is  $30^\circ$ , the number of sides of the polygon is .... 6.....

7 The altitude of an equilateral triangle whose side is 4 is .... [Answer may be left in radical form.] 7.....

8 If  $\cos x = \sin 30^\circ$ , angle  $x$  contains ... degrees. 8.....

9  $D$  is the mid-point of side  $AB$  of triangle  $ABC$ , and a line from  $D$  parallel to  $AC$  cuts  $BC$  in  $E$ . If  $AC = 9$  inches, then  $DE = \dots$  inches. 9.....

10 If in triangle  $ABC$ , angle  $C = 90^\circ$ ,  $AB = 30$  and  $BC = 15$ , then angle  $B$  contains ... degrees. 10.....

11 If the circumference of a circle is  $14\pi$ , the area of this circle in terms of  $\pi$  is .... 11.....

12 The area of a regular polygon whose perimeter is 80 and whose apothem is 12 is .... 12.....

13 If the area of a sector of a circle is to the area of the circle as 1:8, then the number of degrees in the angle of the sector is .... 13.....

Directions (questions 14-18) — Indicate the correct answer to each question by writing on the dotted line at the right the letter  $a$ ,  $b$  or  $c$ .

14 If triangle  $ABC$  is divided into two congruent triangles by the median drawn from vertex  $C$ , then triangle  $ABC$  must be (a) isosceles, (b) equilateral or (c) right. 14.....

15 If the diagonals of a quadrilateral bisect each other, the quadrilateral is always a (a) rhombus, (b) rectangle or (c) parallelogram. 15.....

16 The locus of points equidistant from the four vertices of a given rectangle is (a) a pair of lines, (b) one line or (c) a point. 16.....

17 If in a rhombus  $ABCD$ , angle  $A = 110^\circ$ , then (a)  $AC = BD$ , (b)  $AC > BD$  or (c)  $AC < BD$ . 17.....

18 As the number of sides of a regular polygon inscribed in a given circle increases, (a) the central angle increases, (b) the apothem increases or (c) each exterior angle increases.

18. ....

Directions (questions 19-23) — Indicate whether each of the following statements is *always* true, *sometimes* true or *never* true by writing the word *always*, *sometimes* or *never* on the dotted line at the right.

19 The diagonals of a quadrilateral divide it into four congruent triangles.

19. ....

20 The center of a circle circumscribing a triangle is inside the triangle.

20. ....

21 If the sum of two angles of a triangle is equal to the third angle, then two sides of the triangle are perpendicular to each other.

21. ....

22 The bisectors of a pair of adjacent supplementary angles are perpendicular to each other.

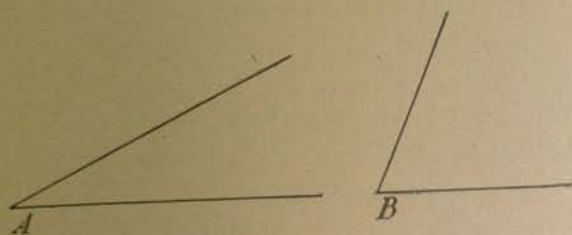
22. ....

23 A straight line parallel to one of two intersecting lines is parallel to the other also.

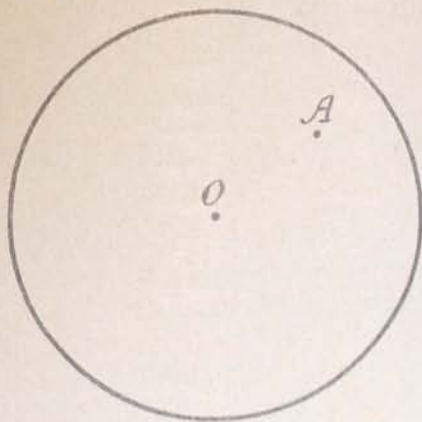
23. ....

Directions (questions 24-25) — Leave all construction lines on the paper.

24 If angles  $A$  and  $B$  are two angles of a triangle, find by construction the third angle of the triangle.



25 Through point  $A$ , construct the chord of circle  $O$  that is bisected by  $A$ .



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